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### 1 [Distance-based outliers: algorithms and applications](#)

Edwin M. Knorr, Raymond T. Ng, Vladimir Tucakov

 February 2000 **The VLDB Journal — The International Journal on Very Large Data**
**Bases**, Volume 8 Issue 3-4

 Full text available: [pdf\(613.90 KB\)](#) Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

This paper deals with finding outliers (exceptions) in large, multidimensional datasets. The identification of outliers can lead to the discovery of truly unexpected knowledge in areas such as electronic commerce, credit card fraud, and even the analysis of performance statistics of professional athletes. Existing methods that we have seen for finding outliers can only deal efficiently with two dimensions/attributes of a dataset. In this paper, we study the notion of *DB (distance-based ...*

**Keywords:** *Algorithms, Data mining, Data mining applications, Outliers/exceptions*

### 2 [An adaptive subdivision method for surface-fitting from sampled data](#)

Francis J M Schmitt, Brian A. Barsky, Wen-hui Du

 August 1986 **ACM SIGGRAPH Computer Graphics, Proceedings of the 13th annual conference on Computer graphics and interactive techniques**, Volume 20 Issue 4

 Full text available: [pdf\(2.48 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

A method is developed for surface-fitting from sampled data. Surface-fitting is the process of constructing a compact representation to model the surface of an object based on a fairly large number of given data points. In our case, the data is obtained from a real object using an automatic three-dimensional digitizing system. The method is based on an adaptive subdivision approach, a technique previously used for the design and display of free-form curved surface objects. Our approach begins wi ...

### 3 [Haptics: Haptics-based volumetric modeling using dynamic spline-based implicit functions](#)

Jing Hua, Hong Qin

 October 2002 **Proceedings of the 2002 IEEE symposium on Volume visualization and graphics**

 Full text available: [pdf\(5.78 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


[terms](#)

This paper systematically presents a novel haptics-based volumetric modeling framework, which is founded upon volumetric implicit functions and powerful physics-based modeling. The volumetric implicit functions incorporate hierarchical B-splines, CSG-based functional composition, and knot insertion to facilitate multiresolution editing and level of details (LODs) control. Our dynamic volumes are semi-algebraic sets of implicit functions and are governed by the principle of dynamics, hence respon ...

4 [Data structures and computational geometry: Adaptive hierarchical RBF interpolation for creating smooth digital elevation models](#)

Joachim Pouderoux, Jean-Christophe Gonzato, Ireneusz Tobor, Pascal Guitton

November 2004 **Proceedings of the 12th annual ACM international workshop on Geographic information systems**

Full text available:  [pdf\(1.68 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)


This paper presents a fast algorithm for smooth digital elevation model interpolation and approximation from scattered elevation data. The global surface is reconstructed by subdividing it into overlapping local subdomains using a perfectly balanced binary tree. In each tree leaf, a smooth local surface is reconstructed using radial basis functions. Finally a hierarchical blending is done to create the final  $C^1$ -continuous surface using a family of functions called Partition ...

**Keywords:** DEM, GIS, approximation, computational geometry, contours, grid, interpolation, scattered data

5 [A PC Cluster System for Simultaneous Interactive Volumetric Modeling and Visualization](#)

Shigeru Muraki, Eric. B. Lum, Kwan-Liu Ma, Masato Ogata, Xuezhen Liu

October 2003 **Proceedings of the 2003 IEEE Symposium on Parallel and Large-Data Visualization and Graphics PVG '03**

Full text available:  [pdf\(1.13 MB\)](#)

Additional Information: [full citation](#), [abstract](#)

A number of problems are well suited for volumetric representation for both simulation and storage, however, the large amount of data that needs to be processed and rendered with these volumes makes interactive manipulation extremely challenging. In this paper, we present a scalable PC cluster system (VG cluster) designed specifically to enable simultaneous volumetric computation and visualization, using compositing hardware devices and the latest PC graphics accelerators. We demonstrate the fle ...

**Keywords:** Graphics hardware, PC clusters, parallel volume rendering, reaction-diffusion patterns, visual computing, volume graphics, volume modeling

6 [Reconstruction and triangulation: Efficient estimation of 3D Euclidean distance fields from 2D range images](#)

Sarah F. Frisken, Ronald N. Perry

October 2002 **Proceedings of the 2002 IEEE symposium on Volume visualization and graphics**

Full text available:  [pdf\(12.39 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Several existing algorithms for reconstructing 3D models from range data first approximate the object's 3D distance field to provide an implicit representation of the scanned object and then construct a surface model of the object using this distance field. In these existing approaches, computing and storing 3D distance values from range data contribute significantly to the computational and storage requirements. This paper presents an



efficient method for estimating the 3D Euclidean distance fi ...

**Keywords:** 3D scanning, ADFs, distance fields, range images

7 Session P8: isosurfaces and distance fields: Distance-field based skeletons for virtual navigation

Ming Wan, Frank Dachille, Arie Kaufman

October 2001 **Proceedings of the conference on Visualization '01**

Full text available:  [pdf\(1.26 MB\)](#)  Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)  
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We present a generic method for rapid flight planning, virtual navigation and effective camera control in a volumetric environment. Directly derived from an accurate distance from boundary (DFB) field, our automatic path planning algorithm rapidly generates centered flight paths, a skeleton, in the navigable region of the virtual environment. Based on precomputed flight paths and the DFB field, our dual-mode physically based camera control model supports a smooth, safe, and sticking-free virtual ...

**Keywords:** camera control, centerline, distance fields, path planning, physically based modeling, virtual colonoscopy, virtual navigation, volumetric environment

8 Computational geometry: Parallel Delaunay triangulation based on circum-circle criterion

Josef Kohout, Ivana Kolingerová

April 2003 **Proceedings of the 19th spring conference on Computer graphics**

Full text available:  [pdf\(228.50 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#)


This paper describes a newly proposed simple and efficient parallel algorithm for the construction of the Delaunay triangulation (DT) in  $E^2$  by randomized incremental insertion. The construction of the DT is one of the fundamental problems in computer graphics. The proposed algorithm is designed for parallel systems with shared memory and several processors. Such hardware (especially with two-processors) became available in the last few years thanks to low prices and at present, there ...

**Keywords:** computational geometry, incremental insertion, parallel Delaunay triangulation

9 Height distributional distance transform methods for height field ray tracing

David W. Paglieroni, Sidney M. Petersen

October 1994 **ACM Transactions on Graphics (TOG)**, Volume 13 Issue 4

Full text available:  [pdf\(2.36 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)


Height distributional distance transform (HDDT) methods are introduced as a new class of methods for height field ray tracing. HDDT methods utilize results of height field preprocessing. The preprocessing involves computing a height field transform representing an array of cone-like volumes of empty space above the height field surface that are as wide as possible. There is one cone-like volume balanced on its apex centered above each height field cell. Various height field transforms of th ...

**Keywords:** distance transform, height field, hierarchical methods, incremental methods, parameter plane transform, parametric/nonparametric HDDT methods, ray tracing, terrain

10 Electromagnetic parasitic extraction via a multipole method with hierarchical refinement 

Michael W. Beattie, Lawrence T. Pileggi

November 1999 **Proceedings of the 1999 IEEE/ACM international conference on Computer-aided design**

Full text available:  pdf(148.60 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The increasing interconnect density and operating frequencies of system-on-a-chip (SOC) designs necessitates extraction of parasitic electromagnetic couplings beyond the localized confines of functional design blocks. In addition, SOC design styles and gridless variable-width routing make it increasingly difficult to use precharacterized library shapes for parasitic extraction. A comprehensive capacitance and inductance extraction solution requires a hierarchical data representation and fas ...

11 The Quadtree and Related Hierarchical Data Structures 

Hanan Samet



June 1984 **ACM Computing Surveys (CSUR)**, Volume 16 Issue 2

Full text available:  pdf(4.87 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

12 Session P8: isosurfaces and distance fields: A complete distance field representation 

Jian Huang, Yan Li, Roger Crawfis, Shao Chiung Lu, Shuh Yuan Liou

October 2001 **Proceedings of the conference on Visualization '01**

Full text available:  pdf(356.82 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)  
 [Publisher Site](#)

Distance fields are an important volume representation. A high quality distance field facilitates accurate surface characterization and gradient estimation. However, due to Nyquist's Law, no-existing volumetric methods based on the linear sampling theory can fully capture surface details, such as corners and edges, in 3D space. We propose a novel complete distance field representation (CDFR) that does not rely on Nyquist's sampling theory. To accomplish this, we construct a volume where each vox ...

**Keywords:** distance fields, graphics, point-based models, polygonal surfaces, volume modeling

13 Voronoi diagrams—a survey of a fundamental geometric data structure 

Franz Aurenhammer

September 1991 **ACM Computing Surveys (CSUR)**, Volume 23 Issue 3

Full text available:  pdf(5.18 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** cell complex, clustering, combinatorial complexity, convex hull, crystal structure, divide-and-conquer, geometric data structure, growth model, higher dimensional embedding, hyperplane arrangement, k-set, motion planning, neighbor searching, object modeling, plane-sweep, proximity, randomized insertion, spanning tree, triangulation

14 Storing a collection of polygons using quadtrees 

Hanan Samet, Robert E. Webber

July 1985 **ACM Transactions on Graphics (TOG)**, Volume 4 Issue 3

Full text available:  pdf(3.00 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

terms

An adaptation of the quadtree data structure that represents polygonal maps (i.e., collections of polygons, possibly containing holes) is described in a manner that is also useful for the manipulation of arbitrary collections of straight line segments. The goal is to store these maps without the loss of information that results from digitization, and to obtain a worst-case execution time that is not overly sensitive to the positioning of the map. A regular decomposition variant of the region ...

**Keywords:** geographic information, hierarchical data structures, line representations, map overlay, polygonal representations, quadtrees

15 Three-dimensional medical imaging: algorithms and computer systems 

M. R. Stytz, G. Frieder, O. Frieder

December 1991 **ACM Computing Surveys (CSUR)**, Volume 23 Issue 4

Full text available:  pdf(7.38 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#), [review](#)

**Keywords:** Computer graphics, medical imaging, surface rendering, three-dimensional imaging, volume rendering

16 Data structures and algorithms for nearest neighbor search in general metric spaces 

Peter N. Yianilos

January 1993 **Proceedings of the fourth annual ACM-SIAM Symposium on Discrete algorithms**


Full text available:  pdf(1.34 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** associative memory, clustering, computational geometry, metric space, nearest neighbor, pattern recognition, randomized methods

17 An optimal algorithm for approximate nearest neighbor searching fixed dimensions 

Sunil Arya, David M. Mount, Nathan S. Netanyahu, Ruth Silverman, Angela Y. Wu

November 1998 **Journal of the ACM (JACM)**, Volume 45 Issue 6

Full text available:  pdf(287.94 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Consider a set of  $S$  of  $n$  data points in real  $d$ -dimensional space,  $R_d$ , where distances are measured using any Minkowski metric. In nearest neighbor searching, we preprocess  $S$  into a data structure, so that given any query point  $q \in R_d$ , is the closest point of  $S$  to  $q$  can be reported quickly. Given any po ...


**Keywords:** approximation algorithms, box-decomposition trees, closet-point queries, nearest neighbor searching, post-office problem, priority search

18 The weighted region problem: finding shortest paths through a weighted planar subdivision 

Joseph S. B. Mitchell, Christos H. Papadimitriou

January 1991 **Journal of the ACM (JACM)**, Volume 38 Issue 1

Full text available: Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index](#)

 pdf(3.92 MB)

[terms](#), [review](#)


The problem of determining shortest paths through a weighted planar polygonal subdivision with  $n$  vertices is considered. Distances are measured according to a weighted Euclidean metric: The length of a path is defined to be the weighted sum of (Euclidean) lengths of the subpaths within each region. An algorithm that constructs a (restricted) "shortest path map" with respect to a given source point is presented. The output is a partitioning of each edge of the su ...

**Keywords:** Dijkstra's algorithm, Voronoi diagrams, shortest paths, terrain navigation, weighted distance functions

19 [An optimal algorithm for approximate nearest neighbor searching](#)

Sunil Arya, David M. Mount, Nathan S. Netanyahu, Ruth Silverman, Angela Wu

January 1994 **Proceedings of the fifth annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  pdf(1.10 MB)


Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)



20 [Exact integer hybrid subdivision and forward differencing of cubics](#)

R. Victor Klassen

July 1994 **ACM Transactions on Graphics (TOG)**, Volume 13 Issue 3

Full text available:  pdf(1.00 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)



Forward differencing is widely used to generate rapidly large numbers of points at equally space parameter values along a curve. A failing of forward differencing is the tendency to generate many extraneous points for curves with highly nonuniform parameterizations. A key result is presented and proven, namely, that a few levels of subdivision, prior to initialization for forward differencing, can improve substantially the quality of the step size estimate, resulting in very few extra point ...

**Keywords:** Be'zier polynomials, parameterization, spline curves

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